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A PRELIMINARY STUDY OF THE INTERACTION OF CONFLICTING CONCEPTS OF CHILDREN BETWEEN THE AGES OF 3 AND 5 YEARS

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A PRELIMINARY STUDY OF THE INTERACTION OF CONFLICTING CONCEPTS OF CHILDREN BETWEEN THE AGES OF 3 AND 5 YEARS*

By Livingston Welch
Hunter College

In a previous paper (4) we described the results of an experiment designed to test the generalization spans of four children below the two year age level. The materials used were a series of different colored plywood plates—32 in number—which varied in form and area from the lowest, 8x8 inches, to the highest, 15¾x¼ inches. The dimensional differential between each plate in the series was an increase of ¼ inch in one dimension and a decrease of ¼ inch in the other. An empty picture frame with no glass and a cardboard "L" were also used. (See Figure 1.)

While it took over 500 repetitions during a period of many weeks to build up a significant association in the minds of the children between the symbol "ate" and the vision of plate 1, we discovered that this same association without further conditioning included plates as high as number 25 in the scale and that after several further conditionings the span stretched in all cases up to the last plate (plate 32) and was maintained there for many months. In some instances the generalizations included the frame and the cardboard "L."

In another paper (5) we showed that these same children during the latter period of testing for generalization were able to discriminate between plates 1 and 6 and some even between plates 1 and 3, proving that the differences between the form and area of the plates were easily discernible for all who took the test.

THE PRESENT PROBLEM

The results of these earlier experiments suggested the following problems, which, in this paper, we have attempted to study:

(1) In what direction are such wide and vague concepts (as, for example, the one we have just described—the concept "ate") eventually delimited at the age levels of 3, 4

* Recommended for publication by Dr. Helen L. Koch, December 10, 1938.

and 5? (2) What effect would one conflicting or opposing concept have on another when both were present in the mind of an older child? (3) In what sense might one of these concepts be said to dominate the other? (4) What effect have different mental sets on the same concept? (5) How do the relationships between such opposing concepts vary with age and intelligence? (6) Is there any associational gradation within the limits of the concepts entertained by children below the age of five?

THE PROCEDURE

A. *The Material*

Part of the material used for these tests was the same series of plates we spoke of in connection with the former experiment—a series of 32 plywood plates. The first was a perfect square 8″x8″ and the last a stick 15¾″x¼″. Going up the scale, each plate increased ¼″ in one dimension and decreased ¼″ in the other. The dimensions of each plate are given in the mechanical drawing. All of the plates from number 12 up varied in color on one side. In these tests the colors were varied as much as possible—red, green, black, plain wood and half black and green.

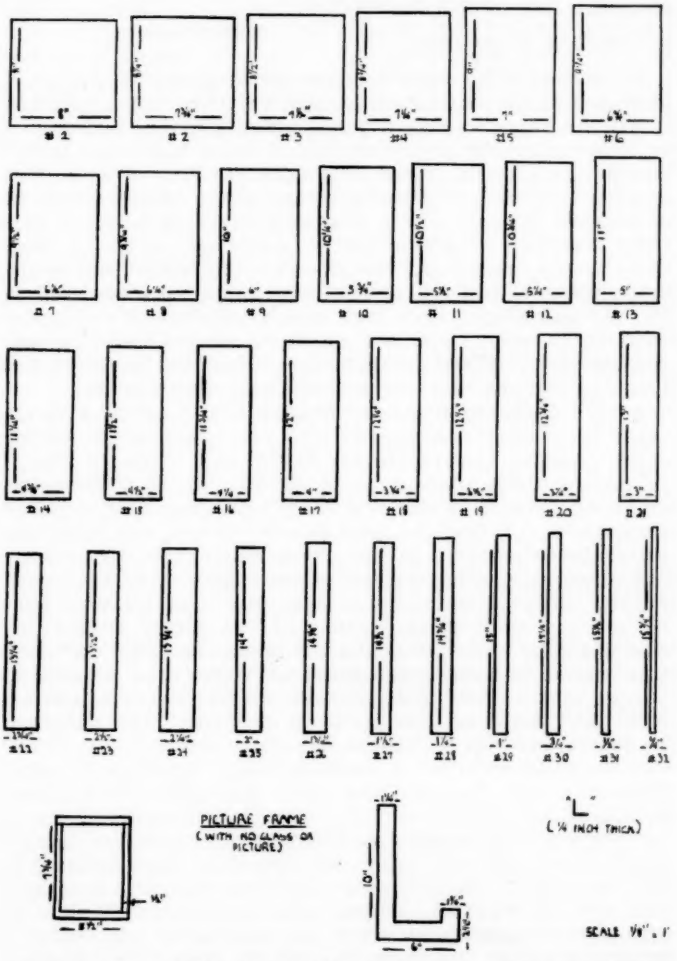
In addition, the "L" shaped object and frame described in the mechanical drawing and the following collection of toys were used: A red disc (3″ in diameter); an unpainted cube 1″x1″x1″; an unpainted block 2″x2″x1″; an unpainted triangular block 3″x2″x2″x1″; a blue book; a cake of Ivory soap; a purse about 4″ long and about 3″ wide; a rubber heel largest size; a white paper card 6″x4″; a package of cigarettes; a pencil; a pen; a cylinder diameter 1″, length 4″; a screwdriver 2″ long, diameter ½″; a mouth-organ small size; a grey rubber cat and elephant less than 12″ long; two red rubber balls: one large and one small.

B. *The Subjects*

The tests were given to 16 children, 8 from the Home for Hebrew Infants (New York City) and 8 from the Normal Child Development Study of Columbia University.[1] The ages of these children ranged from 33 to 60 months. The intelligence quotients referred to in the tables are based on Re-

[1] I wish to express my gratitude to Miss M. Creed, Dr. L. Barenberg, and Dr. Rippin of the Home for Hebrew Infants, and to Dr. M. McGraw of the Normal Child Development Study of Columbia University, for their courtesy and cooperation in allowing me to give these tests and for giving me testing rooms. I am also indebted to Mrs. Mary Lukomnik for her assistance and for her many valuable suggestions.

THE SCALE OF PLATES



N. B. The scale of ⅛" = 1′ is not true because of a necessary reduction of approximately one-third in making the cut.

vised Stanford-Binet test which we ourselves gave to the children of the Hebrew Home for Infants. The Binet scores for the children of the Normal Child-Study were taken from the files of this institution.

C. *Method of Testing*

1. At least five minutes were spent engaging the child in conversation and dispelling shyness. We would then ask him if he cared to play a game which might afford him a chance of showing his cleverness. We instructed him to tell us what he thought the objects shown to him might be and assured him that any name he called an object would be considered correct. There were but two exceptions to this rule. Before he began the test we made certain that he had the concept "plate" and "stick"—the first, which was to include plate 1, and the second, which was to include plate 32. He was shown these two objects separately and asked what they were. If he had no knowledge of them he was conditioned 10 times to each one and tested 5 or 6 times to make certain that he was properly conditioned.

2. We began each test by placing 5 or 6 of the toys already mentioned before him. The one question put to the child when we pointed to an object was, "What is this?" In among these objects, *plate 32* was placed. When the child identified plate 32 as "a stick," it was quickly removed from the group and the next lowest plate in the scale was surreptitiously placed in the group, while further questioning concerning other types of objects continued. We called on the child to identify at least one extra-serial object in between each identification of the plates in the series. Plate by plate we continued down the scale until the child ceased to identify the plates as "sticks" and changed to the use of the word "plate" or "board." In one or two cases a child used the word "dish" instead of "plate." This synonym we did not attempt to change. One child (*Subject E H*) of her own accord employed 3 concepts—dish, board and stick. Whenever such changes took place, the child was required to make identifications of the new plate in order to make certain that this change from, let us say, "stick" to "plate" was definite and not accidental. The child using 3 concepts in connection with the scale had identified *plate 1* as dish and *plate 32* as stick. Hence, when she identified *plate 18* as board we continued down the scale until she changed from the use of the term "board" to "dish." In all other cases as soon as such changes were made, we stopped proceeding down the scale and, always beginning with plate

1, started up the scale until the child changed back to identifying the plates as "stick." Again, we questioned the child at the point of change to make certain that the change was definite.

3. After descending and ascending the scale, we asked the child to identify the "L" and the Frame. (This material was used in the tests of the 4 children below 24 months of age.) Lastly, the child was shown plates 1 and 32 together and asked to identify each.

4. A careful record was kept of the identification of all the objects in the group. We were particularly interested in finding what extra-serial material the child would identify as either plate or stick.

D. *The Motivation*

The motivation and cooperation in every case was quite strong. The tests took approximately 30 minutes and the children showed no evidence of tiring from the repeated questioning. No rewards were given, but the children were continually praised for whatever answer they gave, and if they desired, allowed to chat for a few minutes in between trials.

E. *Special Terminology*

1. *The Descending Span* is the span of concepts stick and plate (in one case the concept board as well) in the progress from plate 32 to 1.

2. *The Ascending Span* is the span of the concepts plate and stick (in one case the concept board) in the progress from plate 1 to 32.

3. *The Flux* is the extent of expansion or contraction of a concept involved by changing from the progress down the scale to the progress up the scale—e.g., going down the scale a child might include in his concept of stick plates 32 to 20; going up the scale this same concept might contract to the span of plates 32 to 26. The Flux here would be 6, based on the units of our scale.

4. *The Integrated Span* is arithmetic mean of the descending and ascending span of the same concept.

5. *The Ratio of Dominance.* Theoretically speaking, the mid point on the scale lies between plate 16 and 17. If a child's "integrated spans" for "plate" and "stick" were respectively 1 to 16 and 17 to 32, we would say that there was no dominance. On the other hand, if the *integrated span* of the concept "plate" was *1 to 29* and that of the concept stick was *30 to 32*, we would describe the ratio of domi-

TABLE I

THE INTRA-SERIAL BOUNDARIES OF THE CONCEPTS "PLATE" AND "STICK"

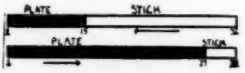
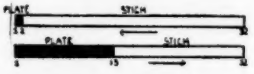
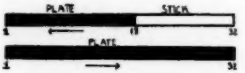
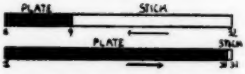
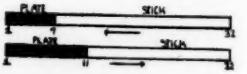
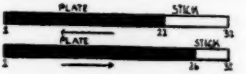
Subject	Age	IQ	Conditioning	Flux	Ratio of Dominance	Descending and Ascending Spans
26	33	55	None	11	ST. 21 to 11	
24	35	106	None	12	ST. 25 to 7	
21	36	92	Plate	14	PL. 25 to 7	
25	38	86	Plate	22	PL. 20 to 12	
20	41	78	Plate, Stick	-2	PL. 30 to 2	
23	41	80	None	5	ST. 23 to 9	
22	42½	91	None	4	PL. 24 to 8	
27	44	75	None	0	ST. 32 to 0	

TABLE 1 Continued

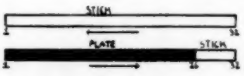
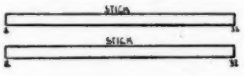
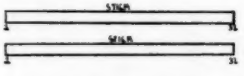
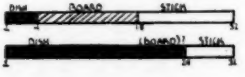
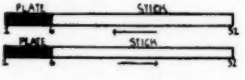
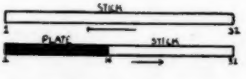
Subject	Age	IQ	Conditioning	Flux	Ratio of Dominance	Descending and Ascending Spans
JMcH	54	111	None	26	ST. 13 to 18	
JLAC	54	112	Plate	26	PL. 18 to 13	
JC	55	102	None	0	ST. 32 to 0	
LR	55	105	Plate	0	ST. 32 to 0	
EH	56	133	None	?	?	
BB	60	137	None	0	ST. 26 to 6	
CHC	60	134	Plate	14	ST. 25 to 7	
RN	60	102	None	4	ST. 18 to 13	

TABLE II

CLASSIFICATIONS MADE OF PLATES 1 AND 32 TOGETHER, THE FRAME AND "L"

Subjects	*Age*	*IQ*	*Combination of Plate 1 and Plate 32*		*The Frame*	*The "L"*
26	33	55	*"Plate"*	*"Plate"*	None	None
24	35	106	"Plate"	"Stick"	"Toy"	*"Stick"*
21	36	92	"Plate"	"Stick"	None	None
25	38	86	.....	.....	.....	.....
20	41	78	"Plate"	"Plate"	*"Plate"*	None
23	41	80	.....	.....	.....	.....
22	42½	91	"Plate"	"Stick"	"Broke"	"Paper"
27	44	75	*"Stick"*	*"Stick"*	1st *"Stick"* 2nd *"Plate"*	*"Stick"*
JMcH	54	111	"Plate"	"Stick"	None	None
LAC	54	112	"Plate"	"Stick"	"A picture"	"A Cardboard"
JC	55	102	"Plate"	"Stick"	"A ruler"	"A gun"
LR	55	105	*"Stick"*	*"Stick"*	*"A stick"* from a picture	"A gun"
EH	56	133	"Plate"	"Stick"	"A window"	"A window"
BB	60	137	"Plate"	"Stick"	"Part of a picture"	"A Cardboard"
CHC	60	134	"Plate"	"Stick"	None	None
RN	60	102	"Plate"	"Stick"	"A little picture"	"A *Plate*"

TABLE III

EXTRA-SERIAL BOUNDARIES OF THE CONCEPTS "PLATE AND STICK"

Subject	*Age*	*IQ*	*The Plate Concept*		*The Stick Concept*	
			Included	*Excluded*	*Included*	*Excluded*
26	33	55	Plates 1-21	"L" Sq. Block Purse Soap cake Triangle (3x2x¾")	Plates 22-32 "L"	Frame
24	35	106	Plates 1-7	Soap cake Flat block Red disc Triangle Poker Chip Frame "L"	Plates 8-32 "L"	Frame
21	36	92	Plates 1-25 Flat Block Pocket-book	"L" Frame Cube Mouth-organ	Plates 26-32	"L" Pencil
25	38	86	Plates 1-20	Sq. Block Soap cake Triangle	Plate 21-32	
20	41	78	Plates 1-30 Frame	"L" Flat block Cube Flat purse Soap cake Mouth-organ Dish (called "a block")	Plates 31-32	"L" Frame
23	41	80	Plates 1-9	Sq. Block Soap cake Triangle	Plates 10-32	Pencil

TABLE III (Continued)

Subject	Age	IQ	The Plate Concept		The Stick Concept	
			Included	*Excluded*	*Included*	*Excluded*
22	42½	91	Plates 1-24	"L" Frame Sq. Block Cube Triangle	Plates 25-32	"L" Frame
27	44	75	Plate 1? Frame	Sq. Block Triangle Soap cake "L"	Plates 1-32 Frame	"L" Frame
JMcH	54	111	Plates 1-14	Purse Heel Sq. Block Disc "L" Frame	Plates 15-32	Screwdriver Pencil "L" Frame
LAC	54	112	Plates 1-18 Disc	Sq. Block A card Heel Cube "L" Frame Purse Book	Plates 19-32	Cylinder (called a "pipe") Screwdriver (called a "tool") Pencil "L" Frame
JC	55	102	Plate 1?	Disc Heel Sq. Block Purse Triangle "L" Frame	Plates 1-32	"L" Screwdriver Pencil Frame

TABLE III (Continued)

Subject	Age	IQ	The Plate Concept		The Stick Concept	
			Included	*Excluded*	*Included*	*Excluded*
LR	55	105	Plate 1? "L" "Frame"	Triangle Purse Cube Heel Purse Book	Plates 1-32 Cylinder Frame (called "a stick from a picture")	"L"
EH	56	133	Plates 1-9	Plates 5-18 Cube Heel Purse "L" Frame	Plates 10-32	Plates 4-18 Screwdriver Cylinder "L" Frame
BB	60	137	Plates 1-6	Mouth-organ Purse Book Frame "L"	Plates 7-32	Cylinder Pen "L" Frame
CHC	60	134	Plates 1-7	Mouth-organ Heel "L" Frame	Plates 8-32	Frame "L" Plates 22, 20 when on experimenter's head, he called a "hat." Same with pen, cat, cylinder.
RN	60	102	Plates 1-20 "L"	Heel Sq. Block Disc Purse A card Frame	Plates 21-32	Screwdriver Cylinder ("a Roller") "L" Frame

nance as plate 29 to 3, meaning that the stick concept was dominant to the extent of 29 to 3.

THE RESULTS

A. *Tables*

In table I all of the data concerning the intra-serial boundaries of the concepts Plate and Stick are given with the exception of the results concerning the identification of plates 1 and 32 together. These will be found in table II. Tables II and III contain all of the data concerning the extra-serial boundaries of these concepts. All of the *Spans* referred to in Table III are "integrated spans."

B. *Comments on the Intra-Serial Boundaries (Tables I, II)*

1. *The Dominance of Contrary Concepts*

In the cases of Subjects 27, JC and LR, we find the same conceptual expanse that we discovered in our study of children below 24 months. Whereas all of the latter included the whole scale of plates in the category "ate," these three present subjects included all of the plates in the category "stick" and one other included all but two plates in the category "plate." None of the children in our former study, even at the subvocal level, had any concept which involved an association with a verbal symbol, such as "stick" or of anything more similar to a stick than "plate." Two of the children of our present experiment (Subjects 27, JC), however, proved to have a definite prior knowledge of plate and stick at the vocal level before the test began, and yet, in both the descending and ascending progressions they included all of the plates of the scale in the stick category and at the end of the tests identified the frame and plate 1 and 32 together as "sticks." Subject LR had to be conditioned for the plate concept. All of these children immediately picked up plate 1 when asked "Where's the plate?" Two of them remarked while so doing. "Here's the plate." It is, therefore, obvious that the dominance of the concept "stick" was limited in virtue of the *mental set* brought about by the question "Where's the plate?" If, during the process of testing, the association between plate 1 and the sound of the word "plate" had completely disappeared, they would have responded differently. All of the extreme cases of intra-serial dominance extended into the extra-serial field in connection with some of the toys.

There was no evidence of dominance of either of the conflicting concepts being based in all cases on the length of time that they had been entertained in the minds of our

subjects, or on the recency of conditioning or on any special preference for the sound of the symbol or for the objects associated with the sound. Moreover, there was no correlation between dominance and age or intelligence.

It is to be noted that in the case of subject EH, the concept "board" appeared in the descending progression, but was completely wiped out in the ascending progression by the expansion of the concept of plate. For one moment when presented with plate 24 the child mentioned the word "board," but immediately corrected herself and said "stick."

2. *Expectancy and Perseveration*

There was nothing in our procedure or setup which could have in any way introduced the element of *expectancy* or anticipation. The children had no reason to expect *anything*. They began the test with no other knowledge than that they were to identify any object that we might show them. No classification that they made was ever questioned. In between the identification of each plate their attention was distracted by the identification of extraneous objects.

Perseveration is hardly a satisfying explanation of the extent of flux which we shall discuss in the next topic. Certainly these cases cannot be compared to instances of the persistence of color sensations. A definite interval of time—anywhere from two to three minutes elapsed (and in two tests, those of Subjects 20 and 21, 4 and 5 minutes)—in between plate identifications during which time the children were distracted by identifications of objects outside the scale.

3. *The Flux and Associational Gradations*

The flux of these children, irregardless of age or intelligence, varied from 26 to -2. In three cases the flux was totally absent in virtue of the complete domination of the concept "stick." Two of these children were in their 55th month and the third in his 44th month. There was only one case of the flux being absent when the domination of one concept was not complete. (We are referring to the results of Subject BB's test.) On the descent the span of the concept plate for this child was 1 -6 and on the ascent it remained exactly the same. In going up and down a scale of this sort, one might expect to find some flux even in the case of an adult subject. The striking feature of these sixteen tests is the variety of flux ranging from -2, 0 up to 26.

None of the children whom we formerly tested below the 24 month level nor those in the present experiment below

the age of 44 months of age gave any direct evidence, by their general behavior, of the existence of associational gradations. By associational gradations we mean a weakening of the associations as the subject proceeds from an examination of materials related to the center of a concept to those related to the periphery of the same concept. In other words, any adult would admit offhand that plate 1 was *more like a square* than plate 6, or that plate 32 was *more like a stick* than plate 21. As he descended the scale from plate 32 he would soon become less and less certain that the objects placed before him were *sticks* until finally he beheld a plate which he considered as being *more like a board*. Entering the realm of the concept board, plates still lower would appear to him as being more and more "like a board."

The behavior of younger children to whom we have just referred, was of the "all or none" variety. Quite positively and unhesitatingly they would call one plate (plate 14, let us say) "a stick," and the next (for example, plate 13) in the same immediate and confident manner they would identify as "a plate." Associational gradations, however, were vaguely and sporadically *suggested* by hesitation or by the mention of one symbol and the quick change to the other symbol by the following subjects, LR, JLAC, and BB. This behavior was by no means reliable. The limitations of self-expression before the fifth year are such that we may hope to find little from the general nature of a child's responses.

At one time we made plans to make use of apparatus which would accurately record the vocal reaction time and volume of vocal response to the question "what is this?" in connection with identifying each plate so that we might empirically prove that the general behavior of the child gave no indication of associational gradation. But we abandoned this plan when we became aware of the fact that so many irrelevant and disturbing factors entered into the situation (such as the child's decrease of interest at this moment and increase of interest at the next, together with innumerable unavoidable distractions) that any exact records which this apparatus might give would be quite meaningless. As a last resort, therefore, we turn to the following theory:

4. *An Interpretation of the Flux and its Possible Relationship to Associational Gradation*

These variations in flux may be explained in terms of differences in associational gradation. It seems reasonable

to believe that there could be no flux when a marked associational gradation existed in the span of one or both of the conflicting concepts near the point at which they meet, that under these conditions the more the flux the less such associational gradation could exist. The converse of these propositions is probable but allows for several possible alternatives. It could happen that associational gradation was absent from the spans of both concepts and yet no flux was manifested because the associations of one of the concepts from one end of the scale to the other were much stronger than the associations of the other concept. Again, there is always the possibility that the absence of flux might be explained by an immediate drop in associational intensity at the periphery of one or both conceptual zones.

Let us return to our first proposition—that where there is a marked flux there can be little or no associational gradation in the span of one or both of the conflicting concepts near the point at which they meet. We shall endeavor to

Figure 2

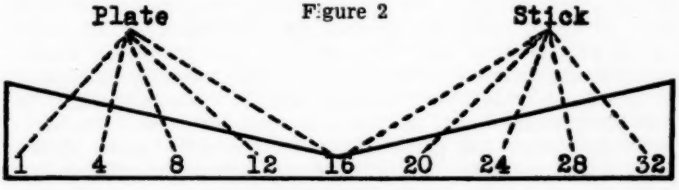


Figure 3

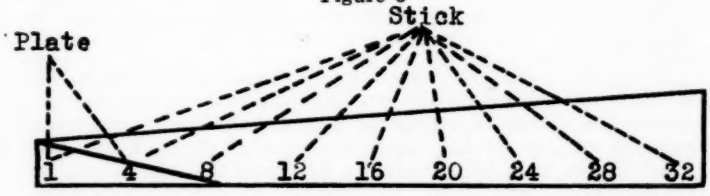
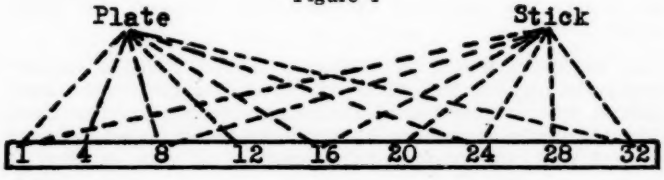


Figure 4



explain what we mean by the following diagrams. The distance from the base line to the full line above it (slanting in Figures 2 and 3) indicates the strength or intensity of the association between any two plates. The slant of the top lines in Figures 2 and 3 represents a steady decrease in associational strength from one point to another. In Figure 2 this decrease extends from plate 1 to 16 in the zone of the concept *plate* and from 32 to plate 16 in the zone of the concept *stick*. Under these conditions the flux would be zero, or at best but one or two degrees. It would also be zero or at best but one or two degrees if a gradation existed as described in Figure 3. Again, if the associations of the concept *stick* were without any gradation but happened to be stronger throughout the scale than associations of the concept *plate*, or if the associations of the concept stick were without gradation up to a point at which the associational intensity of this concept suddenly dropped below the associational strength of the opposing concept, there would be no flux. On the other hand, if the associations between any plate on the scale and either of the conflicting concepts were of equal strength, as described in Figure 4, the flux would be the greatest. Theoretically speaking, the maximum would be a flux of 32. The two instances of a flux of 26 (subjects JMcH and JLAC) were a close approach to this maximum. Note in table II that both of these subjects identified the plate and stick correctly when shown plate 1 and plate 32. Here, there seems to be no alternative. It is almost inconceivable that with little or no gradation near the boundary line between the conflicting conceptual zones there could be an absence of flux or even a flux of small degree.

When we refer to associations of greater of less intensity we have in mind both the contiguous relations existing between the vision of any plate in the scale and one of the symbols of the conflicting concepts and, in addition, the relations of similarity existing between the vision of the plates themselves (e. g., the contiguous relations between symbols and objects, as presented in the diagram by broken lines, and the relations of similarity between the visual data).

In the cases where the concept *stick* dominated the entire scale, the concept *plate* was later brought to the foreground by the mention of the symbol "plate" in the question "Where's the plate?" Here, the association between plate 1 and this aspect of the mental set showed itself to

be more intense, for a moment or two, than the one existing between plate 1 and the concept stick.

The case of Subject 20 is the example of a flux of minus quantity. Still, this flux is very slight, and may be explained by the fact that this child had to be conditioned to both stick and plate. It is one exception where a child was tested for the descending span on one day and for the ascending span two days later. During this interval the stick associations might have increased in strength.

The above diagrams over-simplify the problem. There is the possibility of a great variety of gradations from the very strong to the extremely weak associations (a sharp decline) to the very strong or very weak which during a progression in either direction on the scale graduate almost imperceptibly. The gradations might be continuous or begin with a plateau or end with a plateau.

We shall make no attempt to explain why our subjects showed such differences in flux or, if our theory is correct, why they showed such differences in associational gradations any more than we would dare to explain why some people have good memories and others have poor ones.

Nor are we prepared to say whether these strong manifestations of flux indicate pronounced suggestibility. The concept "suggestibility" is much more complex than that of associational gradation. It is possible that suggestibility might be *partially* explained in terms of a lack of associational gradation, but we suggest that there are other elements as well, and that people found to be "suggestible" as far as identifying our plates might not be suggestible as far as other data were concerned. As yet, we have neither found nor devised any suggestibility tests suitable for children as young as our subjects, so as to establish adequate correlations between "general" suggestibility and the flux.

C. Comments on the Extra-Serial Boundaries (Tables II, III)

All that we could hope to discover in our examination of the extra-serial field were *some* aspects of boundaries of the concepts plate and stick in connection with flat material and long thin "stick-like" material.

1. *Responses to Unknown Material*

The tendency of the children below 24 months in our former experiment and of those in the present experiment was to extend the generalization spans of concepts already existing to include unknown material which was very remotely similar to objects belonging to these categories.

The only factor that in any sense delimited this tendency to generalize to the full extent of the remotely similar were *conflicting concepts.* Two of three children below 24 months included both the frame and the "L" in the concept "ate." In our present experiment two children between 41 and 44 months of age (one with a wide and the other with an extremely narrow span of the concept plate) included the frame in the concept plate. Below the 45 month age level, five of them included the frame in the concept stick and four of them included the "L" in the concept stick. These materials were unknown to them. All of the children from 4½ to 5 years of age were likewise puzzled when asked to identify the frame and the "L," but out of eight, only two included the frame and the "L" in the plate concept and only one of them included the "L" in the stick concept. It is interesting to note that these two children (55 and 60 months of age) had the lowest IQ's in the older group.

Some of the three year old children included such remotely similar objects in the concept plate as a pocketbook, a flat block, and one of the 4 year old children included a red disc (diameter 3 inches) in the same concept. None of the children included the cylinder in the concept stick, except Subject LR (age 55 months) who made the distinction between the higher plates which she called *"flat* sticks" and the cylinder which she described as "a *round* stick."

Nearly all of the 4 and 5 year old children were hesitant and cautious in identifying any object that they did not know. The 3 year old children were not and if at a loss for a word sometimes called the object a "thing" or a "toy." The cleverer older children preferred not to commit themselves at all. Subject JLAC (age 54 months) required a great deal of persuasion under these conditions. When she finally made an attempt she protected herself by saying "If I *wanted* to call it something I would call it a 'so and so,' if I *really* wanted to."

2. *Relations of Value*

As might be expected, there was a strong tendency in the older children (4 to 5 years) to add to their classifications of the purposes of the objects shown to them. The association between use and the setting of objects was so strongly established in the mind of Subject CHC (age 60 months) that though she identified the cat, the cylinder, a package of cigarettes and the higher plates correctly, the very moment that any of these were placed on the ex-

perimenter's head she referred to them as "hats." None of the other children gave this response.

D. The Ability to Discriminate

All of the children below 24 months in our former experiment, all of the 4 and 5 year old children and three of the 3 year old children in the present experiment, were given discrimination tests about the same time that they were tested for generalization. (5)

The infants below 24 months were given tests over an extended period, the others were only tested once. Each test was preceded by 10 conditionings, which consisted of showing the child a candy on plate 1, allowing him to see it disappear under this plate as it was placed on a frame alongside of another plate. He was then induced to pick up plate 1. The lowest test involved the use of plates 1 and 21, the highest, plates 1 and 2. There were 10 trials to each test and a child was not credited with passing unless he averaged 90% or more.

Before the children in our former tests had finished their generalization tests they were all able to discriminate plate 1 from plate 7. One child could discriminate plate 1 from plate 3. The three 3 year old children with no retesting over an extended period were, on an average, able to discriminate plate 1 from plate 6, while the 4 and 5 year old children were, on an average, able to discriminate plate 1 from plate 3½.

E. *The Basis of Generalization and Discrimination*

The one characteristic upon which the children from 19 months to 53 months based their generalizations and discriminations was Form. Value relations played a minor role in the identifications of the three year old children but a very much more important role in the identifications of children who closely approached five years. We are not denying that color and size affected generalizations and discriminations, but these qualities did not appear to be as influential as the other qualities. Children 3, 4 and 5 years of age frequently described one plate as a red plate and another as a black plate, but there was no evidence of color alone carrying them out of the realm of a general concept such as plate or stick.

SUMMARY

The Problem

The purpose of this study was to continue a former survey of the generalization spans of children, with the use

of the same calibrated material, consisting of 32 plywood plates varying in color and changing uniformly in Form by an increase of ¼ inch in one dimension and by decrease of ¼ inch in the other. The children (19 to 24 months) in the former experiment were conditioned over an extended period of time to associate the word "ate" with the first plate (8" x 8"). As soon as such an association was established they initially generalized as far as plate 25 and with but one or two conditions extended the span of generalization to plate 32 (15¾" x ¼"). The 16 children in this experiment were between 3 and 5 years of age. Most of them entertained the concepts "plate" and "stick" before the tests began. Hence, our attention was centered mainly on the interaction of these conflicting concepts, as in between the identification of extraneous material, the children were asked to classify the plates both ascending and descending the scale. We were not only interested in studying the intra-serial boundaries of these two concepts, but also in catching a glimpse of some of the parts of their extra-serial boundaries—to discover what extraneous materials were included in the limits of concepts plate and stick.

General Comments

1. Though there was ample proof that all of our subjects entertained the concepts plate and stick before and after the tests, one concept frequently dominated the other in an extreme degree. In three cases the concept "stick" dominated the entire scale. There was no evidence that such dominance was correlated to age, intelligence or previous training. Opposing mental sets, induced by leading questions, interfered with these dominances, but unless such conditions were continued the former dominance reappeared.

2. In many cases the change from a progression down the scale to a progression up the scale caused a contraction of the span of the concept stick and extensions of the span of the concept plate. The degree of these contractions and expansions varied from 0 to 26 (the unit being based on the number of plates). The flux (as we called the contraction and expansion) was not correlated with age or intelligence, nor could it be explained in terms of *expectancy*, since no factor in the general situation in any stage induced expectancy.

3. The general behavior of the children did not directly suggest the existence of any associational gradations. For example, as the children proceeded down the scale they did

not seem to be less and less certain that the object before them was a stick. After identifying, let us say, 10 of the higher plates as "stick" a child might identify the 11th as a "plate" with the same positiveness that he had identified the last as "stick." There were one or two doubtful exceptions.

4. *In interpreting* this flux we gave reasons for believing that where there was a marked flux there could be little or no associational gradation in the span of one or both of the conflicting concepts near the point at which they meet. We stated that the converse of this proposition was probable, but admitted several possible alternatives.

5. The tendency of the children below 24 months in our former experiment and of those in our present experiment was to extend the generalization spans of already existing concepts to include unknown material which was very remotely similar to the objects belonging to these categories. The only factors that in any sense delimited this tendency to generalize to the full extent of the remotely similar were conflicting concepts. The children of five with high IQ's were a little more cautious and were reluctant in identifying objects that they did not know.

6. The one characteristic upon which the children from 19 months to 53 months based their generalizations and discriminations was Form. Value relations played a minor role in the identifications of the three year old children, but a very much more important role in the identifications of the children closely approaching five years.

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